

Synanthropisation of the Diplopoda Fauna of Poland

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ABSTRACT

More than 5,000 specimens of millipedes belonging to 40 species have been collected and analysed from synanthropic sites in Poland. Six main zoogeographical elements were distinguished. The European element was represented by 26 species. Four ecological elements were distinguished, from which synanthropic species were most abundant in Warsaw (13 species).

RÉSUMÉ

Anthropisation de la faune de diplopes de Pologne.

Plus de 5000 spécimens de diplopes appartenant à 40 espèces ont été collectés dans des sites anthropisés de Pologne et étudiés. Six composantes zoogéographiques principales ont été distinguées. La composante européenne est représentée par 26 espèces. On a distingué par ailleurs 4 composantes écologiques, pour lesquelles les espèces synanthropiques étaient plus abondantes à Varsovie (13 espèces).

INTRODUCTION

Most faunistic and ecological publications are dedicated to national parks, protected areas and other natural environments. Only a few deal with habitats that have been created or modified by human activities.

Towns, as a typical example of a new habitat created by man for man, are interesting places for studying processes of plant and animal colonisation, ecological adaptation and behavioural changes among native fauna. Within towns the process of synanthropisation occurs, which leads to the colonisation of urban areas by species with different ecological specialisations. These species and groups of species are able to overcome the ecological barriers and colonize the direct environment of man. In this way they enrich the ecosystem, forming at the same time new values for people themselves. Factors controlling these processes and influencing the development of fauna in "urbicœnoses", should be recognized as of great importance for making forecasts as to evaluate them in the phase of planning housing estates, and to control them in the most convenient way for man and the ecosystem.

MATERIAL AND METHODS

During a 6 year period, 1974 - 1979, faunistic and ecological studies on the animals inhabiting towns in Poland have been carried out at the Institute of Zoology PAS in Warsaw. These studies were aimed at answering a number of theoretical and practical questions concerning the state and the role of the fauna in urban environment (TROJAN, 1981).

So far, most of the studies on millipedes (Diplopoda) in Poland have been carried out in natural habitats. Relatively few workers were interested in habitats transformed by human activities. The research project mentioned above created opportunities to study the influence of synanthropic factors on the millipede fauna on a large scale. Warsaw was treated as a model of synanthropic processes which can take place everywhere.

RESULTS

During the study period more than 5,000 specimens of millipedes belonging to 40 species were collected and analysed from synanthropic sites in Poland. Six main zoogeographical components were distinguished. The European component was represented by 26 species. Four ecological components were distinguished, from which synanthropic species were most abundant in Warsaw (13 species).

Habitat types

The studied localities can be grouped into the following five main types of habitats (NOWAKOWSKI, 1981) (Fig. 1).



FIG. 1. — Location of the study plots in Warsaw. 1 - suburban areas; 2 - parks; 3 - housing estates; 4 - lawns; 5 - greenhouses.

1. Suburban areas. An urban wood - a nature reserve - with a surface area of over 130 ha. It is located on the Vistula river left bank, dominated by a lime-oak-hornbeam forest (*Tilio-Carpinetum*), in places modified towards a secondary mixed forest. The woods are inhabited by

10 species of millipedes (Table 1). Six of them: *Glomeris connexa*, *Heteroporatia bosniensis*, *Nemasoma varicorne*, *Julus terrestris*, *Leptoiulus proximus* and *Ophiulus fallax* were found only in this kind of habitat. They are not able to enter the centre of town.

2. Parks. There are several old parks in Warsaw covered by a variety of greens, with patches of preserved forests and an area of up to 86 ha. They create good conditions for eleven species of millipedes living there. Most of them belong to synanthropic species such as *Cylindroiulus caeruleocinctus* and *Kryphioiulus occultus* which achieve their abundance. Some of the natural environment species can also live there.

3. Greens of housing estates. This type of habitat can hardly be characterized, since it varies in size and floristic composition. The only factors they share are great intensity of cultivation and very strong penetration by people and domestic animals. In such conditions only four synanthropic species of millipedes can exist.

4. Lawns and courtyard greens. In general, these types of habitats do not exceed 250 m² in surface area. The lawns, especially along streets, are heavily contaminated with salt and subject to frequent drought conditions. The species composition is poor and consist of four species only.

5. Greenhouses. These are the most artificial of all types of habitats which have been created by human activity. They have high and constant temperature as well as humidity. Diplopods dwelling there are typical synanthropic species which origin from tropics. In Warsaw, seven species of millipedes have been recorded from greenhouses. Three of them (*Ophiodesmus albonanus*, *Oxidus gracilis* and *Cylindroiulus truncorum*) live exclusively in this type of habitat.

TABLE 1. — Check-list of the *Diplopoda* occurring in Warsaw. Numbers of specimens collected.

	Suburban areas	Parks	Housing estates	Lawns	Green-houses	Total
<i>G. connexa</i>	13					13
<i>H. bosniensis</i>	40					40
<i>B. superus</i>	3	27	7	1		38
<i>P. inconstans</i>		9	5	36		138
<i>P. complanatus</i>	28	1				29
<i>O. albonanus</i>					1	1
<i>O. gracilis</i>					7	7
<i>B. guttulatus</i>		32			3	35
<i>B. tenuis</i>		1				1
<i>C. palmatus</i>		1			7	8
<i>N. varicorne</i>	1					1
<i>P. fuscus</i>	1	1				2
<i>N. venustus</i>		5				5
<i>C. frisius</i>	52	17	29	10	2	110
<i>C. truncorum</i>					8	8
<i>C. caeruleocinctus</i>		242	3	57		302
<i>K. occultus</i>		449			2	451
<i>J. terrestris</i>	15					15
<i>L. proximus</i>	11					11
<i>O. fallax</i>	8					8
<i>U. foetidus</i>	4	94	6	6		110
<i>P. germanicum</i>	35					35
Total	211	967	50	110	30	1368

Species groups

Analysing the species composition of the millipedes fauna of synanthropic habitats, we can conclude that the Diplopoda occurring in Warsaw belong mostly to the species showing high ecological amplitudes and due to this they are able to inhabit several urban habitats (JEDRYCZKOWSKI, 1982). From an ecological point of view, they can be divided in three groups depending on the transformation of environment.

1. The first group consists of native species having a great ecological tolerance which are able to enter into suburban greens, but are not able to live in the central part of town. It is represented by *G. connexa*, *H. bosniensis*, *P. complanatus*, *N. varicorne*, *P. fuscus*, *J. terrestris*, *L. proximus* and *O. fallax*.

2. The second group represents mainly synanthropic species, which originates mainly from the south and west part of Europe, they dwell in parks and estate greens but occasionally can inhabit some natural or seminatural habitats. As representatives of this group, *P. inconstans*, *C. latestriatus* (= *frisius*) and *C. caeruleocinctus* can be mentioned.

3. The third group is build up by species of tropical or unknown origin. Usually, they live in a variety of greenhouses (where they can achieve a high numbers of individuals) sometimes they can live out of buildings for a long period, especially when winters are mild.

DISCUSSION

The species diversity and the number of specimens occurring in towns depend on the age and type of the inhabited greens. The highest specific richness occurs in old parks, with large green patches, dense lawns with shrubs and where the litter is well preserved, providing shelter for animals.

A high percentage of millipedes belong to the group of expansive species, which have successfully colonized almost the whole Europe. The high ecological amplitude enables them to adapt to changing habitat conditions. Synanthropic species, especially those belonging to the genus *Cylindroiulus*, native of the Mediterranean, are a good example here. Urban pressure firstly eliminates the species associated with forests and thickets. They still can live in the suburbs but they do not colonize parks and housing estates.

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